Calibration of VIIRS F1 Sensor Fire Detection Band Using Lunar Observations

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Visible Infrared Imager Radiometer Suite (VIIRS) Fight 1 (F1) sensor includes a fire detection band at roughly 4 microns. This spectral band has two gain states; fire detection occurs in the low gain state above approximately 345 K. The thermal bands normally utilize an on-board blackbody to provide on-orbit calibration. However, as the maximum temperature of this blackbody is 315 K, the low gain state of the 4 micron band cannot be calibrated in the same manner as the rest of the thermal bands. Regular observations of the moon provide an alternative calibration source. The lunar surface temperature has been recently mapped by the DIVINER sensor on the LRO platform. The periodic on-board high gain calibration along with the DIVINER surface temperatures was used to determine the emissivity and solar reflectance of the lunar surface at 4 microns; these factors and the lunar data are then used to fit the low gain calibration coefficients of the 4 micron band. Furthermore, the emissivity of the lunar surface is well known near 8.5 microns due to the Christiansen feature (an emissivity maximum associated with Si–O stretching vibrations) and the solar reflectance is negligible. Thus, the 8.5 micron band is used for relative calibration with the 4 micron band to de-trend any temporal variations. In addition, the remaining thermal bands are analyzed in a similar fashion, with both calculated emissivities and solar reflectances produced.